also bipolar, and that the southern *Echiurus chilensis* and *Priapuloides australis* have their counterparts in the northern *E. unicinctus* and *P. typicus*. Prof. R. Blanchard describes six new species of leeches belonging to the genera Trachelobdella (1), Helobdella (4), and Semiscolex (1). Mr. Frank E. Beddard deals with a large number of new Oligochæta. Thus he establishes a new genus of Limicolæ, Hesperodrilus, with four species, and among Terricolæ he describes thirteen new species of Acanthodrilus and eight of Microscolex. He regards the south of South America as the headquarters of these two genera, while the Geoscolecidæ and the genera Kerria and Ocnerodrilus are as distinctively northern. The collection included eight Lumbricidæ, which are all European species, and probably imported. Dr. Michaelsen also makes a report on the Terricolæ, adding some new forms and adjusting the names of others in accordance with his system of classification. Dr. H. Ude deals with the Enchytræidæ, and points out that the genera represented in the sub-Antarctic region, *e.g.* Enchytræus, Pachydrilus, and Marionina, are familiar European or even boreal genera. This indicates the world-wide distribution of an ancient fresh-water fauna. But, curiously enough, the genus Mesenchytræus is not represented at all in the Antarctic region.

Prof. Ernst Ehlers reports on the Magellan Polychæta—eighty-five species (thirty-six new) in fifty-five genera—and gives an interesting description of the general features of the polychæt fauna, such as the strong representation of Syllidæ and Phyllodocidæ. The following species occur in the boreal and notial regions, but not in the intermediate tropical and subtropical seas:—*Nephthys longisetosa, Glycera americana, Scolecolepis vulgaris, Arenicola assimilis,* and *Notomastus latericeus*. How this "bipolarity" is to be accounted for Prof. Ehlers does not say.

Dr. von Linstow has some very remarkable facts to relate regarding nematodes. Thus *Ascaris osculata* of northern Fissipedia occurs also in exclusively Antarctic forms, and *Ascaris adunca* occurs in northern and southern fishes the habitats of which in no way overlap. From cases like these, and from the character of the free-living nematodes, von Linstow argues that in past ages the conditions of life and evolution must have been more uniform over the earth, and the occurrence of types much more widespread. Dr. O. Steinhaus points out that four species of Chætognatha are common to the far north and the far south. As to nemerteans, Prof. O. Bürger directs attention to the complete absence of Protonemertini from southern waters, and to the occurrence of *Carinoma patagonica* in the Straits of Magellan—its only known congener being the rare *C. armandi* of the British coast. He thinks that the resemblance of the boreal and notial nemerteans is undeniable, so long as we fix our attention on genera.

Prof. Lönnberg remarks on the close resemblance between three southern cestodes and Scandinavian species. It is the similarity of host that counts. The northern host of *Bothridiotaenia erostris* is a gull or a fulmar; the southern host of the same is a penguin. Prof. Max Braun establishes a new genus of trematode, Lophocotyle, which ranks among the Monocotylidæ; Dr. Rudolf von Ritter-Záhony establishes two new genera of polyclads; and Prof. L. Böhmig describes three new rhabdocœlids and five new triclads.

It should be noted that most of the authors have increased the value of their contributions by including in their survey all the forms recorded from the Magellan region. As regards the question of "bipolar" distribution, to which most of them refer, the impression left on a reader's mind is that it is very difficult to generalise. It appears that the state of affairs differs in regard to different sets of animals. In some cases, *e.g.* holothurians, the dissimilarity of boreal and notial forms is more striking than the resemblance; in other cases, *e.g.* Bryozoa, there is a marked resemblance as to the genera represented at the two poles, but this does not extend to any identity of species; in a few cases, *e.g.* Gephyrea, the same species occur north and south, but some of the instances of this kind have to be discounted when the species in question (*e.g.* of Cirripedia) are cosmopolitan.

BOTANY AT THE BRITISH ASSOCIATION.

THE proceedings of Section K at Dublin, under the presidency of Dr. F. F. Blackman, were rather above than below the average standard of quality, and were characterised by more homogeneity than is usually the case, a large proportion of the papers dealing with certain aspects of physiological botany. Several of these dealt with those fields of investigation in which progress at present consists in the application of physico-chemical principles and quantitative methods to the experimental analysis of complex physiological phenomena into their component processes and factors.

The presidential address (NATURE, October 1, vol. lxxviii., p. 556), which was entitled "The Manifestations of the Principles of Chemical Mechanics in the Living Plant," dealt with this aspect of physiology, and urged the view that in some cases the internal metabolic changes of the organism which follow external changes should be regarded, not as reactions of protoplasm to stimulation, but as inevitable alterations of metabolic reaction-velocity.

Physiological Papers.

The death of individual cells as brought about by chemical poisons or high temperatures is a complex phenomenon, the experimental quantitative investigation of which leads to important biological conceptions. Two papers were communicated on this subject after the delivery of the presidential address. The first, by Miss Harriette Chick, dealt with the death-rate of bacteria under the action of disinfectants. When a crowd of similar bacteria are treated with any disinfectant they die off at such a rate that the "number surviving" after successive intervals of time fall into a logarithmic curve. The process of killing is thus continuous, and there is no definite time of exposure which can be said to be fatal. The killing goes on in a way that recalls the progress of a monomolecular reaction according to the "law of mass." It is shown that the different times of resistance of the bacteria are not due to permanent differences between the individuals, but that these differences are temporary and possibly phasic. Viewed in this way, the rate of killing is a phenomenon of reaction-velocity, and it is found that increase of temperature accelerates the reaction-velocity of disinfection just as it does that of a chemical reaction.

This paper was followed by one by Miss Nora Darwin and Dr. F. F. Blackman, dealing with the death-rate of cells of higher plants in fatal conditions. When it is realised that bacteria die off logarithmically under uniform unfavourable conditions, it becomes at once interesting to determine whether the cells of a tissue of a higher plant die in the same independent way, or whether their closer protoplasmic connection leads to their behaving all alike. Experiments on this point are being carried out with strips of potato, fuchsia stamens, and other organs, using the shortening of the tissue resulting from loss of cell-turgor on death as an indication of the progress of the death-rate. An optical lever was used to record the shortening, and submersion in hot water as the fatal condition. The cells of the tissue appear to behave like a number of bacteria, and to die off progressively and logarithmically, but this interpretation has yet to be firmly established. Seeds submerged in water at 42° C. to 50° C. exhibit clearly a logarithmic death-rate.

Other physiological papers were communicated on Thursday by Prof. H. H. Dixon, on the influence of living cells on the transpiration current, and by Prof. Bose, on the mechanical and electrical responses of plants. Prof. Dixon described experiments to show that there is no evidence of vital activity as a contributory factor in raising the transpiration current in a branch. The rate of transmission of water in a branch from above downwards was found to be the same before and after killing by steam or picric acid. The fading of leaves on a steam-killed branch is shown to be directly due to a poison liberated into the transpiration current by the dead cells, and is not to be taken as evidence that some preexisting vital raising force has been extinguished by the killing.

Prof. Bose gave a summary of his views on plant-responses as expounded in his recent books. His paper was illustrated by experiments with the ingenious apparatus devised by him for investigating the mechanical and electrical responses universally exhibited by plants on stimulation.

Friday morning was occupied with a series of five papers on photosynthesis by workers at Cambridge. The president gave an introductory paper on photochemical action in the test-tube and the leaf, which consisted of a short account of the quantitative laws governing such chemical changes *in vitro,* followed by an inquiry as to how far the conditions under which photolysis of CO_2 takes place in the leaf would allow these laws to come into action.

Mr. Thoday then read a paper on increase in dry weight as a measure of assimilation. This is the first critical examination of Sachs's classical method, with the object of directly determining the nature and magnitude of possible errors that the procedure involves. Many investigators have used it confidingly, but recently it has been suggested that the method gives uniformly too high results, possibly due to fixation of water in the cell during insolation, in addition to the formation of carbohydrates. Mr. Thoday has proved that there is no such fixation of water by finding that organic analysis of the increased carbon content makes it clear that practically the whole increase of dry weight may be reckoned as carbohydrate. Further, it is shown that the excessively high values sometimes obtained are really due to another cause, namely, to shrinkage of the leaf-surface by transpiration. Records were exhibited showing that an attacked leaf of sun-flower fluctuates in area to the extent of 5 per cent. in the course of a few hours, shrinking during periods of insolation, recovering when passing clouds check the rate of transpiration.

Following this Mr. A. M. Smith gave an account of his work on the factors influencing photosynthesis in water plants. This work was carried out with an apparatus designed by Dr. F. F. Blackman, in which a complete knowledge of the whole amount of assimilation is obtained by combining an analysis of the bubbles given off by the assimilating plant with an estimation of the diminution in CO_2 content of the water flowing over the plant.

The magnitude of assimilation in relation to the amount of dissolved CO_2 in the surrounding water was first investigated, and it was found that the assimilation varied proportionally with the CO_2 supply until the limit set by the temperature or light intensity (in the particular conditions of experiment) was reached. No indication of an optimum CO_2 content was found, and assimilation only begins to be depressed when the water is one-third saturated with CO_2.

It was further shown that aquatic flowering plants possessing an "internal atmosphere" can work up a greater proportion of the CO_2 supply than an aquatic moss (Fontinalis) which has no "internal atmosphere."

Mr. Parkin communicated a paper on the carbohydrates of the snowdrop leaf and their bearing on the first sugar of photosynthesis. The work of Brown and Morris in 1893 on the carbohydrates of the leaf of Tropæolum brought forward the new view that sucrose rather than glucose plays the important part in the "up-grade" sugars of the foliage leaf. In that leaf the sugar metabolism is complicated by the fact that starch is abundantly present, and from it glucose could arise by hydrolysis. In the snowdrop starch never occurs, so that this leaf is a simpler case for investigation. Sucrose, levulose, and dextrose were found in abundance, and the fluctuations in their relative amounts followed. With increasing assimilation the sucrose steadily increases, while the amounts of levulose and dextrose remain fairly constant. This is interpreted as favouring the view that sucrose is directly formed in photosynthesis and that the hexoses are formed from it by hydrolysis.

This view falls more into line with the conception that the first sugar is split off from a complex protein aggregate than with Baeyer's view of progressive condensation from formaldehyde.

A paper by Mr. J. M. F. Drummond on the time factor in assimilation was communicated by the president. Experiments were made on the amount of assimilation taking place in cut-off leaves in a chamber lighted by artificial light continuously for several days. After a time the power of assimilation diminishes, and the object of the work was to find the precise explanation of this result. It was proved that part of this diminution is due to accumulation of the products of assimilation in the leaf, and that the power of assimilation is regained after the leaf has been kept in the dark for a period and has diminished its carbohydrate stores by vigorous respiration. A second cause of diminished assimilation is the shutting of the stomata by the high general turgor of the epidermis brought about by the high sugar content of the sap. This factor can be recognised by the increased assimilation which immediately follows incisions into the leaf or the application of dry air. The effect of stomatal closure can be overcome by increasing the CO_2 supply in the air current through the chamber.

Ecological Papers.

Friday afternoon was occupied by two papers on the woodlands of England, by Mr. Tansley and Dr. Moss respectively. Mr. Tansley devoted the first portion of his paper to an attempt to show that the great majority of English woodlands are actually derived from natural woods, and retain enough of their primitive character to be treated as natural or semi-natural plant associations. He went on to distinguish four great types of natural English woodland, determined by soil characters—the oak type, the oak-birch-heath type, the ash type, and the beech type—and to explain the distribution, character, composition, and principal subtypes of each of these.

Dr. Moss, agreeing with Mr. Tansley's main scheme of classification, dealt especially with the woods of the Pennines, on which he distinguished upland oak (*Quercus sessiliflora*) and birch woods, with transitions between them. These, which occur on siliceous soils, he regarded as differentiations of the oak-birch-heath type, according to the factor of altitude. Opposed to these, and of essentially different character, are the woods belonging to the ash type, which occur on the mountain limestone of that region. The woods of the lowlands of northern England agree ecologically with those of the south, but the beech type is entirely absent.

Prof. R. H. Yapp gave an account of his observations on the evaporating power of the air in different strata of the marsh formation of Wicken Fen. The average evaporation in the free air above the tallest plants is about 1·7 times that in the layer immediately below the tops of the tallest plants, and 6·8 times that in a stratum 18 inches below the surface of the vegetation and just above the soil-level.

Morphological and Palaeobotanical Papers.

On Tuesday morning Mr. W. C. Worsdell read a paper on the origin of dicotyledons, in which he based his view of the phylogeny of this group on the doctrine of "anaphytosis," or the building up of the plant body from a colony of distinct individuals or "phytons," budding one from another as the stem grows in length. He held that the facts of embryogeny in vascular plants are entirely opposed to the ordinary view that the plant primarily consists of a single shoot bearing leaves as lateral appendages. The primary individual of the colony of phytons, as represented by the embryo of the higher plant, is phylogenetically derived from the bryophytic sporogonium, of which the capsule, seta, and foot correspond with the primary phyllome, caulome, and root of the vascular plant. The facts of embryonic segmentation and the dominance of the cotyledonary organs were cited as being opposed to the monaxial view, in which the stem is regarded as the dominant organ and the leaves as appendages. From this position the author deduced the primitiveness of the monocotyledonous type with its terminal cotyledon, which must have preceded the dicotyledonous type, in opposition to Miss Sargant's theory of the derivation of the monocotyledonous from the dicotyledonous type by fusion of the two cotyledons. Anatomical evidence was adduced to show that the scattered bundle arrangement of monocotyledons is primitive, and that vestiges of this arrangement are found in many dicotyledons. The absence of anatomical evidence in seedlings pointing to such a conclusion was attributed to space-relationships. Finally, pleiomery of the flower was recognised as primitive, and the prevailing trimery of monocotyledons as reduced from such a condition. Mr. Worsdell's views were criticised, mainly from a hostile standpoint, by Miss E. N. Thomas, Mr. Parkin, Prof. Bower, and others.

Prof. H. H. W. Pearson, of Cape Town, contributed a note on the morphology of endosperm, in which he described the development of the endosperm in Welwitschia and discussed the homologies of this tissue with the endosperm in the angiospermous embryo-sac. At an early stage of development of the endosperm of Welwitschia all the cells are multinucleate, while at a later stage each cell has a single nucleus (Pearson, Phil. Trans. R. Soc., 1906). An examination of material collected in 1907 showed that the latter condition is brought about by the fusion of nuclei in the cells of the young endosperm. The original nucleus of an embryo-sac produces by repeated division rather more than 1000 nuclei; the sac then elongates, and the free nuclei are re-distributed, with the result that two regions are differentiated, a micropylar region with scattered nuclei and a lower region with more crowded nuclei. The sac is next divided into compartments, those at the micropylar end having two to six, and the others usually twelve or more nuclei. The compartments containing more than six nuclei are converted by nuclear fusion into uninucleate cells; the nuclei in the micropylar compartments remain free, and the wall of each "cell" grows upwards into an embryo-sac tube ("prothallial tube"), into which pass the nuclei and cytoplasm; these nuclei are functional gametes. The conclusion is that the endosperm of Welwitschia represents a new organism, which it is proposed to call the *trophophyte*, intercalated in the life-cycle, belonging neither to the sporophyte nor to the gametophyte. It is the opinion of the author that the trophophyte of Welwitschia is phylogenetically related to the endosperm of angiosperms.

On Tuesday Prof. Weiss read a paper on the primary wood of Lepidodendron and Stigmaria. A new Stigmaria was described in which the xylem of the stele consists of a central strand of long, narrow, protoxylem-like elements mixed with parenchyma, surrounded by normal centrifugal secondary wood. This type of stele was compared with that of *Selaginella spinosa* and of the "hypocotyl" of *S. Kraussiana*, and also with that of *Lepidodendron selaginoides*. The general relations of the steles of the Lepidodendreæ were discussed.

Mr. H. H. Thomas communicated a paper by Mr. Newell Arber and himself on the structure of *Sigillaria scutellata*, Brongn. This was the first full account of the structure of a Sigillarian stem of the Rhytidolepis type. The primary xylem of the stele forms a continuous ring of scalariform tracheids surrounding the medulla. Secondary xylem is also present. The characteristic external ribs are really formed of cortical tissue, not of fused leaf-bases, and are largely composed of phelloderm. A ligule in its pit was demonstrated for the first time. The leaf-trace in the leaf-base contains a double xylem strand with widely separated xylem groups of the Sigillariopsis type.

Mrs. D. H. Scott described some curious spindle-shaped bodies in Burntisland material, naming them *Bensonites fusiformis*. She inclined to the view that they are glandular structures belonging to *Stauropteris burntislandica*, with which they are associated. A sporangium of this species was found to contain germinating spores.

Miscellaneous Papers.

On Thursday Colonel H. E. Rawson contributed a striking account of colour changes in flowers produced by controlling insolation. He has found that by shading various plants (such as nasturtiums) from the direct rays of the sun during certain hours of the day the colours of the flowers produced are changed from scarlet and orange to mauve, and in other cases to deep carmine. The variations thus produced breed true, both from cuttings and seeds. In other instances bronze, old-gold, rose-salmon, and sallow flesh-coloured flowers have been produced by similar means. Dahlias and other flowers appear to be as susceptible as nasturtiums to this treatment.

Mr. W. L. Balls contributed two papers on the mechanism of mitosis and on the natural crossing of the cotton plant.

Mrs. D. H. Scott read a paper on the contractile roots of the aroid *Sauromatum guttatum*, in which she showed that if the tuber of this plant is planted on the surface of the soil it throws out leaves and subsequently disappears below the surface, and in two months' time is found at a depth of 6 inches. The descent is caused by the thick fleshy roots sent out from the upper surface of the tuber, which firmly attach themselves to various objects in the soil, and then contract to about half their original length, pulling the tuber down. Later on these contractile roots are cut off from the tuber by regular alseris layers. If the tuber is replaced on the surface it sends out a fresh set of contractile roots, and is again pulled down to the normal depth.

Mr. M. Wilson contributed notes on the life-history of *Haematococcus lacustris*, in which he described the results of various culture experiments on this species. The red cells were found to be produced in starved liquid cultures, and to be alone capable of withstanding the effects of drying. Dr. Lotsy contributed an interesting paper on the segregation of characters of a perfectly fertile species-hybrid.

Mr. Harold Wager made a contribution on the optical behaviour of the epidermal cells of leaves. He discussed Haberlandt's theory that the convergence of light rays brought about by the lens structure formed by the papillæ of the epidermal cells of many leaves brings about a differential illumination of the protoplasm on the basal wall, and thus creates a stimulus which results in the appropriate orientation of the leaf to the incident light. It was pointed out that the objection to this theory, based on the absence of epidermal lens papillæ from heliotropically sensitive grass-seedlings, may be met by the fact that the epidermal cells of the first (sheathing) leaf and of the young leaves enclosed in the sheath do actually cause convergence of light rays in spite of the absence of papillæ. In the author's opinion too little attention has been paid to the view that the lens structures in question may be concerned with the more efficient illumination of the chloroplasts. It is also possible that the structures in question are accidental, and not to be regarded as adaptations, since they also occur on the lower epidermis of various leaves, on the epidermis of some petals, and in the fungus Russula. Mr. Wager exhibited well-defined photographs of various objects made through these epidermal lenses.

Monday morning was devoted to a joint discussion with Section D on the determination of sex. This is reported in the article on "Zoology at the British Association" (NATURE, October 22, vol. lxxviii., p. 647).

Members of Section K were fortunate in being able to meet in Prof. H. H. Dixon's beautiful new botanical institute at Trinity College, where everything was arranged for their comfort and convenience.

The sectional excursion was held on the Saturday to the Murrough of Wicklow, a long stretch of shingle beach backed by marsh, under the leadership of Mr. R. Lloyd Praeger.

MR. LLOYD GEORGE ON THE ENDOWMENT OF UNIVERSITIES.

ON November 13 the University of Wales conferred the degree of Doctor of Laws, *honoris causa*, on Mr. Lloyd George. At the complimentary banquet given by the University College of North Wales, Lord Kenyon announced a donation of 1000*l*. from Sir Herbert Roberts to the college building fund. In replying to the toast in his honour, Dr. Lloyd George alluded to the sacrifices the Welsh people have made in building up their system of higher education, and pointed out that the University of Wales has entirely altered the status of the Welsh people. It would be the worst thing for the Government to take the task entirely out of their hands, but the time has arrived for the Government to render further assistance, and one great need of the colleges is a very commonplace one—cash. Further assistance of a substantial character would make a vast difference in the immediate prospects. One of the ablest committees has investigated the claims of the Welsh colleges, and the conclusions arrived at are very favourable. The committee indicated several directions in which more could be done if the colleges had more money.

Dr. Lloyd George had to consider the report of the committee, and it was his duty as Chancellor of the